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The Saudi Dental Journal

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ORIGINAL ARTICLE

Patterns and etiology of maxillofacial fractures in Riyadh City, Saudi Arabia

Walid A. Abdullah ^{a,b,*}, Khaled Al-Mutairi ^c, Yasser Al-Ali ^d,
 Abdullah Al-Soghier ^d, Abdullah Al-Shnwani ^d

^a OMFS Department, Dental College, King Saud University, Saudi Arabia

^b Oral Surgery Department, Dental College, Mansoura University, Egypt

^c Consultant of Oral and Maxillofacial Surgery, King Saud Medical City, Riyadh, Saudi Arabia

^d Interns in Dental College, King Saud University, Saudi Arabia

Received 6 May 2012; revised 21 September 2012; accepted 3 October 2012

Available online 24 November 2012

KEYWORDS

Maxillofacial trauma;
 Pattern of facial fractures;
 Etiology of maxillofacial
 fractures

Abstract *Objective:* The aim of the present study was to study the etiologies and patterns of maxillofacial fractures in patients treated in Riyadh City, Saudi Arabia, between 2007 and 2011.

Patients and methods: Data were obtained through a retrospective review of 237 patients admitted to the King Saud Medical City Dental Department with a diagnosis of maxillofacial trauma. After excluding patient files with incomplete or unclear records, and cases in which computed tomography showed no evidence of fracture, the files of 200 patients with a diagnosis of maxillofacial fracture were included in the study. For each case, patient's sex and age, pattern of facial fractures, and cause of injury were recorded on a data sheet. The data were transferred to an SPSS (ver. 16.0; SPSS Inc., Chicago, IL, USA) spreadsheet for statistical analysis. The chi-square test was used to test the association between two categorical variables or factors (age group, cause) with p value set at $p < 0.05$, and t -test value at < 0.05 and independent.

Results: Motor vehicle accidents were the most common cause of maxillofacial fractures in most age groups, especially in males. Within the study sample, mandibular fractures were significantly more common than middle-third facial fractures (56.4% vs. 43.6%; $p = 0.006$). Among mandibular fractures, parasymphysal fractures were most common (47%), followed by condylar fractures (35.3%). Most (77.2%) middle-third facial fractures involved the zygomatic complex, and the incidence of such fractures differed significantly between male and female patients. $p = 0.72$, not significant.

Conclusion: Males were more prone to maxillofacial fractures, perhaps as a result of the conservative nature of Saudi society, as the rules of Saudi Arabia do not allow the females to drive. Motor vehicle accidents were the most common cause of maxillofacial fractures in patients aged

* Corresponding author at. OMFS Department, Dental College, King Saud University, Saudi Arabia. Mobile: +966 563847261.

E-mail address: drwaleedsurgery@yahoo.com (W.A. Abdullah).

Peer review under responsibility of King Saud University.



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10–29 years, indicating the high demand for the application of stricter traffic rules to reduce the rate of such accidents.

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1. Introduction

The causes of maxillofacial fracture have changed continuously over the past three decades, and they continue to do so. The main causes of this fracture type worldwide are traffic accidents, assaults, falls, and sport-related injuries. Many studies have examined the incidence and causes of maxillofacial injury (Adekeye, 1980; Afzelius and Rosen, 1980; Hagan and Huelke, 1961; Khalil and Shaladi, 1981; Motamedi, 2003; Van Hoof et al., 1977).

The epidemiology of facial fractures varies among populations with respect to type, severity, and cause (Giroto et al., 2001). An understanding of maxillofacial trauma aids the assessment of behavioral patterns in people in different countries and helps to establish effective measures for injury prevention and treatment (Maliska et al., 2009).

The patterns of maxillofacial trauma in Saudi Arabia are poorly studied. To our knowledge, only two studies have focused on this subject (Al Ghamdi, 1998; Ansari et al., 2000; Ministry of Interior, 1997). Thus, the aim of the present study was to examine the etiologies and patterns of maxillofacial fractures in patients treated in Riyadh City, Saudi Arabia between 2007 and 2011.

2. Patients and methods

This study was approved by the College of Dentistry Research Center, King Saud University. Data were obtained through a retrospective review of 237 patients admitted to the King Saud Medical City (KSMC) Dental Department in Riyadh City between January 2007 and September 2011 with a diagnosis of maxillofacial trauma. KSMC is one of the main hospitals with maxillofacial facilities affiliated with the Ministry of Health of Saudi Arabia and is considered to be the primary trauma center in Riyadh.

After excluding patient files with incomplete or unclear records, and cases in which computed tomography (CT) showed no evidence of fracture, the files of 200 patients with a diagnosis of maxillofacial fracture were included in the study. The following data were recorded for each patient: sex and age; facial fracture pattern (orbital, nasal, maxillary, mandibular, zygomatic), determined using CT images and operative reports; cause of injury; and time of admission.

Patients were divided into six age groups (0–9, 10–19, 20–29, 30–39, 40–49, and 50–59 years). Data were recorded on a special data sheet and transferred to an SPSS (ver. 16.0; SPSS Inc., Chicago, IL, USA) spreadsheet for statistical analysis. The

Table 1 Anatomical distribution of mandibular fractures and gender distribution.

			Gender		Total
			Male	Female	
Mandibular	Condyle	Count	34	8	42
	Angle	Count	29	4	33
	Body	Count	26	4	30
	Symphysis	Count	10	2	12
	Dentoalveolar	Count	8	3	11
	Ramus	Count	2	0	2
	Coronoid	Count	2	1	3
	Parasymphysis	Count	48	8	56
Total	Count		102	17	119

Table 2 Anatomical distribution of maxillary fractures and gender distribution.

			Gender		Total
			Male	Female	
Mid Facial ^a	Maxillary	Count	2	0	2
	ZOC	Count	63	8	71
	Nasal	Count	5	1	6
	Dentoalveolar	Count	11	2	13
	Le Fort I	Count	13	1	14
	Le Fort II	Count	6	0	6
	Le Fort III	Count	2	0	2
Total	Count		81	11	92

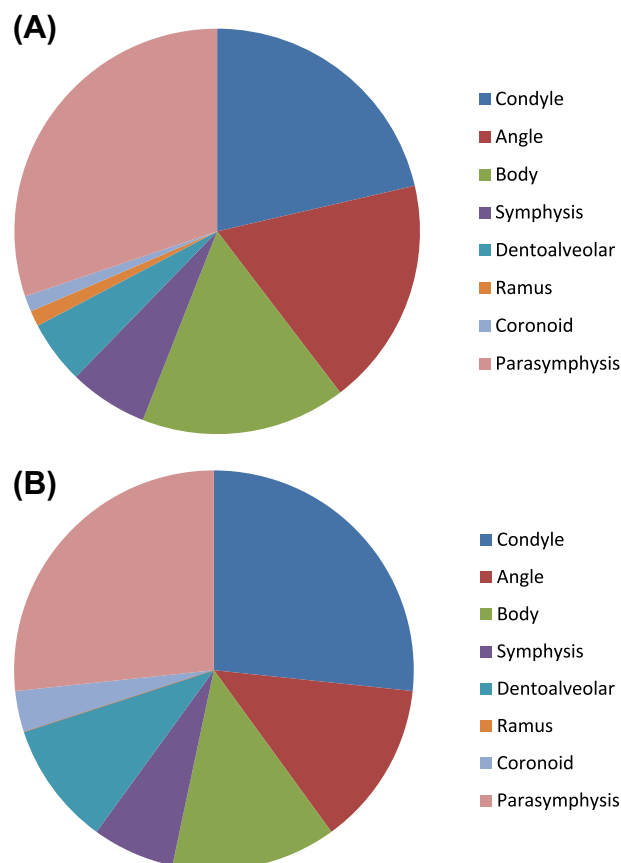


Figure 1 Anatomic distribution of mandibular fractures in male (A) and female (B) patients.

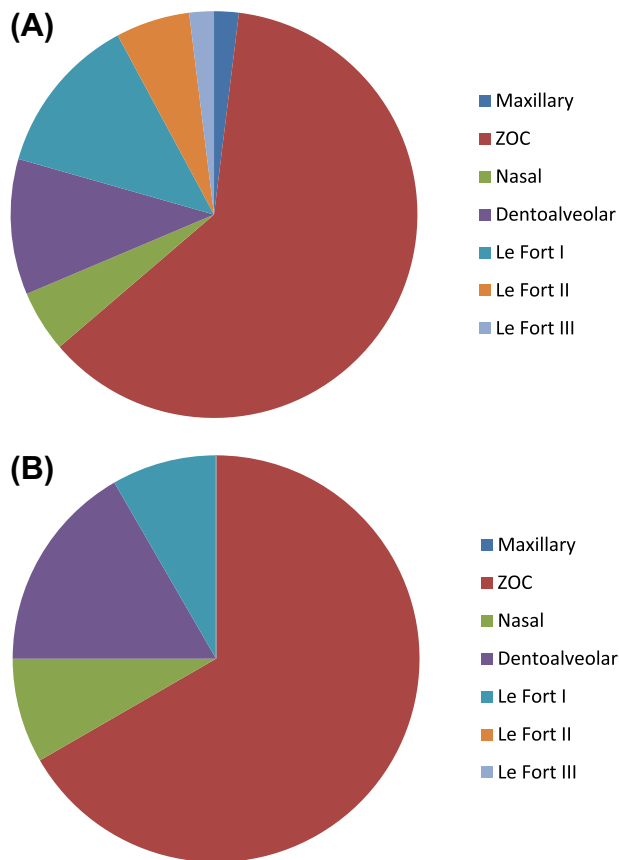


Figure 2 Anatomical distribution of middle-third facial fractures in male (A) and female (B) patients.

chi-square test was used to test the association between two categorical variables or factors (age group, cause) with p value set at $p < 0.05$, and t -test value at < 0.05 and independent.

3. Results

In the present study, data from the files of 200 patients [172 males (86%), 28 females (14%)] with 211 maxillofacial fractures were analyzed. Mandibular fractures (119/211, 56.4%) were significantly more common than middle-third facial fractures (92/211, 43.6%; $p = 0.008$). Among mandibular fractures, parasymphiseal fractures were most common (56/199, 47%), followed by condylar fractures (42/119, 35.3%), but the incidence did not differ significantly ($p = 0.063$). Most (71/92, 77.2%) middle-third facial fractures involved the zygomatic complex, and the incidence of such fractures differed significantly between male and female patients ($p = 0.72$, not significant). The distribution of fractures by anatomic site and patient sex is shown in Tables 1 and 2 and Figs. 1 and 2.

Causes of maxillofacial fracture in each age group are shown in Table 3 and Fig. 3. Among males, motor vehicle accidents were the most frequent cause of injury (86.1%) in all age groups except those aged 0–9 years, among whom falls were the most common cause (50%). In female patients aged 10–19 (75%) and 20–29 years (77.8%), motor vehicle accidents were the most common cause of injury; in those aged 0–9 (60%) and 30–39 years (66.7%), falls were the most common cause (Table 4, Fig. 4). Whereas, falls were not the main cause for other groups. The numbers of males and females with fractures caused by motor vehicle accidents differed significantly ($p = 0.00$). Other causes of fracture are shown in Tables 3,4 and Figures 3,4. Significant differences by age group were seen in the entire sample.

Table 3 Causes of maxillofacial fractures in relation to age groups in male patients.

Gender				Cause					Total
				MVA	Falls	Violent Assaults	Sports	Others	
Male	Age 0–9	Count		3	4	1	0	0	8
		% within age		37.5%	50.0%	12.5%	.0%	.0%	100.0%
		% within Cause		2.9%	13.3%	4.5%	.0%	.0%	4.7%
	Age 10–19	Count		38	10	5	7	1	61
		% within age		62.3%	16.4%	8.2%	11.5%	1.6%	100.0%
		% within Cause		36.2%	33.3%	22.7%	63.6%	25.0%	35.5%
	Age 20–29	Count		45	10	9	4	1	69
		% within age		65.2%	14.5%	13.0%	5.8%	1.4%	100.0%
		% within Cause		42.9%	33.3%	40.9%	36.4%	25.0%	40.1%
	Age 30–39	Count		12	3	5	0	1	21
		% within age		57.1%	14.3%	23.8%	.0%	4.8%	100.0%
		% within Cause		11.4%	10.0%	22.7%	.0%	25.0%	12.2%
	Age 40–49	Count		5	3	2	0	1	11
		% within age		45.5%	27.3%	18.2%	.0%	9.1%	100.0%
		% within Cause		4.8%	10.0%	9.1%	.0%	25.0%	6.4%
	Age 50–59	Count		2	0	0	0	0	2
		% within age		100.0%	.0%	.0%	.0%	.0%	100.0%
		% within Cause		1.9%	.0%	.0%	.0%	.0%	1.2%
	Total	Count		105	30	22	11	4	172
		% within age		61.0%	17.4%	12.8%	6.4%	2.3%	100.0%
		% within Cause		100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

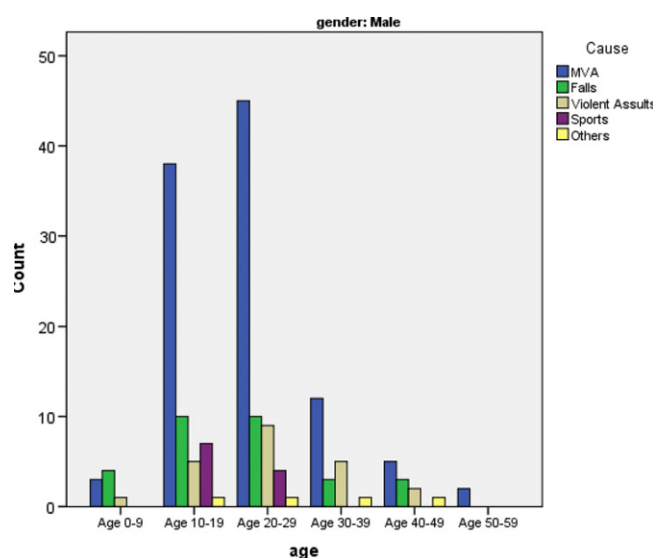


Figure 3 Causes of maxillofacial fracture in male patients by age group.

4. Discussion

The etiology and incidence of maxillofacial fracture vary by country, socioeconomic status, and cultural characteristics (Adhikari et al., 2012; Haung et al., 1990). Examination of the epidemiology of this type of fracture within a given country is important to determine what is needed to improve the quality of life and health of its citizens (Maliska et al., 2009).

Our finding that mandibular fractures were the most common type of maxillofacial fracture (56.4%) is comparable to the results of two 4 year retrospective studies of the etiologies and patterns of facial fractures in the United Arab Emirates (UAE; 53%) (Klenk and Kovacs, 2003) and in Sharjah,

UAE (51%) (Al Ahmed et al., 2004). This comparability reflects the similar geographic locations and cultural habits of Saudi Arabia and the UAE, and the similar time periods during which the studies were conducted. Moreover, despite differences in geographic location and cultural properties, our result also agrees with that of Maliska et al. (2009), who found that mandibular fractures accounted for 54.6% of maxillofacial fractures in Brazil. Our result was slightly higher than those obtained in a 5 year retrospective study in Brazil (44.2%) (Brasileiro and Passeri, 2006) and a 1 year retrospective study in a hospital in Belo Horizonte, Brazil (39.97%) (Chrcanovic et al., 2004).

In contrast to our results, a 10 year review in Austria (Gassner et al., 2003) showed that the most common facial injury site was the middle-third of the face. This difference reflects the main etiologies of fracture in the studies, which were motor vehicle accidents in the present study and activities of daily life and falls in Gassner et al. (2003).

In the present study, motor vehicle accidents (60.85% of the whole sample) were the main etiological factor in maxillofacial injury in males (61% males, 60.7% females), except those aged 0–9 years. This finding is in agreement with those of many studies (Al Ahmed et al., 2004; Bataineh, 1998; Olasoji et al., 2002; Tanaka et al., 1994), and can be explained by the large increase in the number of vehicles and expansion of road networks within and between cities as a result of rapid economic growth since the oil era began to increase the motorization rate in 1973 (Al Ahmed et al., 2004; Ansari et al., 2000; Ministry of Interior, 1997). In contrast to our study results, other studies have reported that assault was the main etiological factor in maxillofacial injury (Al Ahmed et al., 2004; Oikarinen et al., 1993; Strom et al., 1991). This difference may be explained by the conservative nature of Saudi culture and cultural differences among countries. The females are not allowed to drive in Saudi Arabia. Moreover, assault between the husband and wife is difficult to be recorded in some cases as the family

Table 4 Causes of maxillofacial fractures in relation to age groups in female patients.

Gender				Cause					Total
				MVA	Falls	Violent assaults	Sport	Others	
Female	Age 0–9	Count	2	3	0	–	–	5	
		% within age	40.0%	60.0%	.0%	–	–	100.0%	
		% within Cause	11.8%	30.0%	.0%	–	–	17.9%	
	Age 10–19	Count	6	2	0	–	–	8	
		% within age	75.0%	25.0%	.0%	–	–	100.0%	
		% within Cause	35.3%	20.0%	.0%	–	–	28.6%	
	Age 20–29	Count	7	2	0	–	–	9	
		% within age	77.8%	22.2%	.0%	–	–	100.0%	
		% within Cause	41.2%	20.0%	.0%	–	–	32.1%	
	Age 30–39	Count	1	2	0	–	–	3	
		% within age	33.3%	66.7%	.0%	–	–	100.0%	
		% within Cause	5.9%	20.0%	.0%	–	–	10.7%	
	Age 40–49	Count	1	1	1	–	–	3	
		% within age	33.3%	33.3%	33.3%	–	–	100.0%	
		% within Cause	5.9%	10.0%	100.0%	–	–	10.7%	
	Total	Count	17	10	1	–	–	28	
		% within age	60.7%	35.7%	3.6%	–	–	100.0%	
		% within Cause	100.0%	100.0%	100.0%	–	–	100.0%	

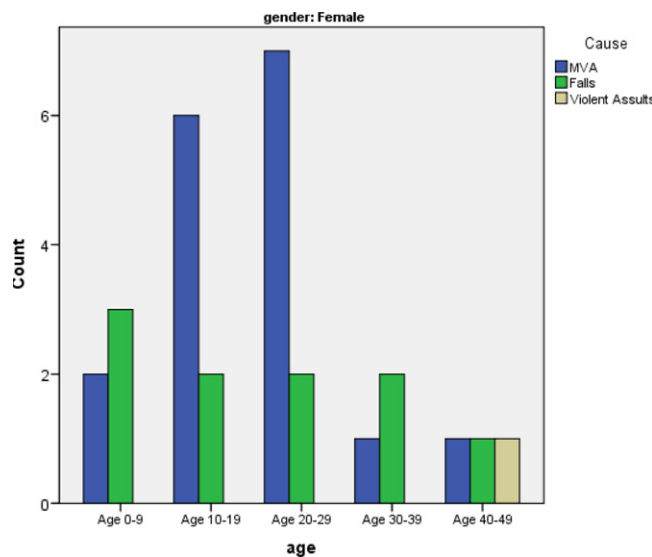


Figure 4 Causes of maxillofacial fracture in female patients by age group.

refuses to say truly, the cause of trauma in case if it was from the husband to his wife. Our finding that the main etiological factor in maxillofacial injury among patients aged 0–9 years was not motor vehicle accidents shows improvement in Saudi citizens' behavior with respect to traffic rules, as the transport of many young children unrestrained in front passenger seats was reported previously in Gulf countries (Al Ahmed et al., 2004; Bener and Jadaan, 1992; Jadaan et al., 1992; Strom et al., 1991).

The male to female ratio in our study (6.1:1) was higher than those reported by many authors, which has ranged from 3:1 to 5.4:1 (Bener and Jadaan, 1992; Chrcanovic et al., 2004; Gassner et al., 2003; Van Hoof et al., 1977), but was in agreement with the ratio (males 92%, females 8%) reported by Al Ahmed et al. (2004). This result reflects the conservative and religious nature of Gulf country societies, which is more pronounced in Saudi Arabia than in the UAE and other Gulf countries; for example, women are not allowed to drive in Saudi Arabia.

Limitations of this study include, a lot of cases were not recorded properly, so they were excluded from the study, and the assault between the husband and wife is difficult to be recorded in some cases as the family refuses to say truly, the cause of trauma in case if it was from the husband to his wife.

5. Conclusion

- Mandibular fractures were the most common maxillofacial fractures among patients treated in Riyadh City, Saudi Arabia.
- Parasympyseal fractures were the most common type of mandibular fracture, followed by condylar fractures.
- Zygomatic fractures were the most common type of middle-third facial fracture.
- Males were more prone than females to maxillofacial fractures, perhaps due to the conservative nature of Saudi society.

- Motor vehicle accidents were the most common cause of maxillofacial fractures in most age groups, especially in males and those aged 10–29 years.
- The study findings highlight the high demand for the application of stricter traffic rules to reduce the rate of motor vehicle accidents.

Conflict of interest

The authors have no conflict of interest to declare.

Acknowledgment

The authors thank the College of Dentistry Research Center, Dental College, King Saud University, and the King Saud Medical City Dental Department for their help and support.

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